1. Introduction

Covered interest (rate) arbitrage must equalize net yields of comparable assets denominated in different currencies taking into account the forward-rate premium. Since simultaneous (swap) transactions in the spot and forward markets eliminate any risks in the exchange rate fluctuations, covered interest parity is expected to hold continuously in an environment with perfect capital mobility. However, it is not so straightforward to establish covered interest (rate) parity empirically. Given that all profit opportunities are exploited, deviations from the parity observed in data can be attributed to one of the following reasons: (i) transactions costs associated with information gathering and processing, brokerage fees and commissions, and taxes on transactions; (ii) differences in treatment of income taxes on yields from assets in different currency denominations; (iii) capital controls in place on movement of short-term investments; (iv) default risk of an asset and political (country) risk of future capital controls; and (v) observation errors including errors in obtaining contemporaneous quotes.

An objective of this paper is to single out as much as possible the portion of deviations from covered interest parity that is caused by capital controls imposed by the Japanese authority in the 1970s. Note that the new Foreign Exchange and Foreign Trade Control Law enacted in December 1, 1980 has eliminated most capital controls on short term assets. It is our conjecture that
we can show measures of apparent unexploited gains from covered interest arbitrage in 1970s but not after December 1980. At the time that the Japanese authority is further trying to “internationalize” Yen, it is most important to document and evaluate quantitatively the impact of the new Law of 1980 on short term capital flows into and out of Japan.

With several arbitrage gain measures developed in this paper, the above-mentioned conjecture are found true. That is, apparent unexploited arbitrage opportunities were detected in the 1970s, suggesting that capital controls were binding before 1980. In particular, capital controls were binding in the direction from the on-shore Japanese asset to the Euro-dollar deposits in the late 1973 and the early 1974, by the magnitude of more than 25% (in annualized yield) apparent gains without exchange rate risk! Between 1975 and 1979, the binding direction was reversed: restrictions on capital flows into Japan were binding. Restrictions on outflow, though mild, were again binding after March 1979 and before the sweeping deregulation in December 1980. There is no sign of apparent unexploited arbitrage gains detectable from our data after 1981. The new Foreign Exchange and Foreign Trade Control Law enacted in December 1980 has been quite effective in establishing short-term capital mobility in and out of Japan since 1981. No sign of distorting government intervention or manipulation was found. We may conclude that the Japanese short-term capital market is completely integrated in the world financial markets.

A few comments on closely related works are in order. Although many works on covered interest parity have been done, a relatively few researchers examined the Dollar-Yen relationship. Otani and Tiwari (1981) and Otani (1983) examined capital controls and covered interest parity between Yen-denominated and dollar-denominated assets. Both works used daily data from 1978 to March 1981. They examined the difference between three-month Gensaki, which are repurchase agreements in Japan, and three-month Euro-Yen deposit rates. They found that the Gensaki rate was higher than the Euro-Yen rate from the beginning of 1978 to March of 1979, and that the reverse was true in the first quarter of 1980. The authors explained these deviations by episodes of capital controls by the Japanese Government. Although their works are pioneering in studying the Yen-Dollar relationship, one wishes to cover periods longer than 1978 and 1981. However, backdating their analysis invites some problems: among others, no Euro-yen data is available before 1975.

This paper improves analysis started by Otani and Tiwari (1981) in three respects. First, by using monthly data, a longer time series of various arbitrage measures are documented. Time series from 1972 to 1984 in this paper makes it possible for us to confirm dramatic deviations from parity in 1973, a gradual convergence toward parity in the latter half of the 1970’s and a dramatic decrease in variances after December 1980. In particular, three-year observations after the Foreign Exchange and Foreign Trade Control Law of 1980 are helpful in evaluating effectiveness of the law.

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2) The use of bid-ask spread for constructing an estimate of transaction costs for various currencies is a relatively new idea. Among others, the following used various bid-ask spreads to construct neutral bands of interest rate parity: Kreicher (1982) on the onshore-offshore dollar-denominated assets, Eaker (1980) for the Euro-market but not including Yen, and Lizondo (1983) on the Peso-Dollar exchange rates.
Second, we examine not only the pair of Gensaki and Euro-Yen, but also other possible pairs involving Euro-Dollars. The parity between Euro-Yen and Euro-Dollar is investigated to check the accuracy of data. Since the Euro-Yen market did not develop until 1975, the reliability of Euro-Yen deposit rate data should be checked through the Euro-market parity relationship. Moreover, for the long time series of arbitrage opportunities dating back prior to 1975, we have to use the parity relationship between Gensaki and Euro-Dollar.

Third, taking into account the bid-ask spreads of exchange rates and Euro-currency deposits as well as transaction taxes on Gensaki arrangements, one-way arbitrage measures are developed to pick up the deviation from parity due to capital controls net of obvious transactions costs. Although the bid-ask spread as a proxy of transactions costs has been used for other currencies, it has not been applied to examine the Yen-Dollar parity before. Interpreting the bid-ask spread as transactions costs, the measures show that parity has been holding between the Japanese (onshore) and Euro (offshore) assets with very few exceptions after December 1980.

In sum, this paper is unique in studying the Yen-Dollar covered interest parity taking into account costs associated with foreign exchange and security transactions for relatively long time span: most series range from 1975 to 1984, but some go back to 1972. One particular series from 1972 to 1984 is reported in an appendix for the benefit of future studies which want to use the indicator of effective capital controls. Studying apparent profit opportunities (net of transactions costs) for separate subperiods before and after 1980, a dramatic effect of the new Law of 1980 is documented. Capital controls are found binding against potential capital flows out of Japan in the late 1973 to the early 1974 and flows into Japan in 1975 and 1978. All measures indicate that covered interest parity holds true since December 1980, implying that the new Foreign Exchange and Foreign Trade Control Law effectively has established free mobility of short-term capital into and out of Japan.

In a study of interest parity, obtaining appropriate data is crucial. Data in this paper are carefully selected to avoid as much as possible the problem of timing and errors in observations. Monthly data are cross-checked with daily data, when possible, in order to make sure that they are on the “end of month” basis. Since time difference prevents us from taking simultaneous quotes between Japanese (onshore) assets and the Euro (offshore) assets, we can at best take quotes on the same day. Daily data of the Euro rates used in Section 4 are simultaneous quotes. Transactions costs associated with the bid-ask spread of foreign exchange and Euro deposits, and the transactions tax on repurchase agreements in Japan are taken into account. Political risks due to the fear of future capital controls are discussed but not explicitly analyzed in this paper. This is not a serious problem, because the capital controls of Japan in the 1970's were expected to be relaxed and actually lifted one by one, as will be explained in the next section. Thus, we

3) Otani and Tiwari (1981) use a definition of transactions costs which is broader than ours. Their transactions costs include “not only brokerage fees but also costs in terms of taxes, search time, political risks, and ways in which market participants need to maneuver around any capital controls.”

4) This paper ignores deviations due to differences in taxation of corporate income from different sources.

5) The Japanese deregulation of capital controls is in contrast to that in France which is described in Frankel (1982). Strictly speaking, we cannot reject an alternative interpretation that the deviations result from the combination of capital controls already in place with a fear of the imposition of additional capital controls.
interpret any significant deviations from parity after transactions costs as evidence that capital
controls already in place became binding.

Covered interest parity is examined for various pairs of onshore and offshore assets denomi-
nated in Yen and in U.S. dollars: Euro-Yen and Euro-Dollar three month deposit rates and the
comparable three-month interest rate in Japan. In Section 3, we define and examine these meas-
ures of arbitrage gains in the traditional way, without taking into account transactions costs repres-
ented by bid-ask spreads. Section 4 is devoted to developing new measures of one-way
arbitrage gains net of transactions costs consisting of the bid-ask spread of foreign exchange and
Euro deposits, and the transactions tax. Positive entries of a measure are interpreted as devia-
tions from parity due to capital controls. The measure which takes into account transactions
costs in one direction is related to the theoretical concept of “one-way arbitrage” in Deardorff
(1979), and an arbitrage condition proposed by Eaker (1980). Daily data in addition to monthly
data are used to make sure that end-of-month monthly data do not have any anomalies. The
last section summarizes findings in this paper, discusses policy implications and points out some
remaining issues.

2. A Brief History of Japanese Capital Controls

Deregulation of Japanese capital controls came in several steps during the 1970’s and was com-
pleted by the new Foreign Exchange and Foreign Trade Control Law of December 1980. Before
1974, most short-term capital flows in and out of Japan were in general restricted. No Japanese
security companies could buy foreign securities and bonds, and no foreign companies could buy
Japanese securities. Opportunities from arbitrage were responded by leads and lags, but not by
capital flows. However, subsequent fluctuations in the Yen were accompanied by deregulation
of capital markets. When the Yen was depreciating quickly, deregulation to encourage inflows
of capital took place; and when the Yen was rapidly appreciating, deregulation to encourage
outflows of capital was introduced. For example, in the wake of Yen depreciation, short-term
government securities became available to non-residents in August 1974, although their interest
rate was (and still is) fixed at a level lower than the market rate. In an attempt to stop a long
process of Yen appreciation in 1977, Japanese security firms and others (with security firms’
intermediation) were allowed to acquire foreign securities. After hitting an all-time high in late
1978, the Yen depreciated rapidly in 1979. In 1979, several steps were taken to encourage capital
inflows to prevent rapid Yen depreciations: Foreign companies were allowed to purchase any
Japanese securities in February and to trade repurchase agreements (Gensaki) in May. It should
be noted, however, that there was a short spell of capital controls tightening between 1977
and 1979. This is one of a few occasions when controls were tightened, only to be deregulated
shortly. The marginal reserve requirement for “free” yen accounts by nonresidents was
increased to 50% in November 1977 and to 100% in March 1978, and then reversed to 50% in
January 1979 and 0% in February 1979. Nonresidents were prohibited from purchasing any
Japanese securities with maturities less than five years and one month from March 1978 to
February 1979.

In December 1980, a new law became effective allowing free flows of capital in and out of Japan
Major outcomes of this law are summarized as follows: Japanese companies and individuals are now allowed to invest in foreign securities without security firm’s intermediation; foreign loans by Japanese no longer need permits, but reporting only; non-residents can purchase and sell Japanese securities without any licensing; non-residents can issue bonds in Japan with prior reporting only; and Japanese residents can open deposit accounts denominated in foreign currencies with market-determined interest rates.

The series of important deregulations mentioned above is expected to make conditions of covered interest parity involving the Tokyo market show a convergence toward zero. Considering the capital controls in place before 1974, it would be expected to find “apparent unexploited profit opportunities” before 1974. The band of deviations from parity is expected to diminish between 1974 and 1980, and should be negligible after 1980.

The interest parity in the Euro market should provide a benchmark for how much deviation is “normal.” Since there have been no capital controls in the Euro-market tradings, covered interest parity between Euro-yen and Euro-dollar deposit rates should hold both before and after December 1980. When we consider the bid-ask spread to single out deviations in the parity between the Tokyo and Euro (onshore-offshore) markets, comparisons are made to the Euro (offshore-offshore) relationship. We conjecture that the onshore-offshore relationship in terms of deviations from the parity should behave differently from the offshore-offshore relationship before the Foreign Exchange and Foreign Trade Control Law of 1980, and behave similarly after the law.

Put differently, one can ask questions whether the new law has actually made any differences. It may have been the case that deregulation for the Japanese investors in 1977 and for the non-residents in 1979 was significant enough so that parity was already holding at the time the new law was introduced; or perhaps the new law only paid lip service to deregulation and included some unwritten barriers. The following sections of this paper will confirm that the new law actually made the difference.

3. Apparent Arbitrage Gains: Simple Measures from 1972 to 1984

A couple of measures of hypothetical arbitrage gains are defined between EUROY, the three-month Euro-Yen deposit rate in London; EURO$, the three-month Euro-Dollar deposit rate in London; and RJA, the three-month repurchase agreement (Gensaki) rate in Tokyo. Measures GAIN 1 through GAIN 2 represent net arbitrage gains by investing in assets denominated in dollars rather than in assets denominated in Yen. Formally,

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6) The law specifies various conditions under which controls can be reimposed: a dangerously unstable Yen; a threat to domestic capital markets, monetary policy, or balance of payments; a substantial threat to a domestic industry; or the inability of Japan to meet international agreements.

7) See appendices for the reasons we select these data and sources and definitions of data. Although I am aware of the importance of precise timing, emphasized in McCormick (1979), it is impossible to obtain simultaneous quotes for Japanese onshore assets and the Euro or the U.S. assets because of a significant time difference.
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\[ GAIN_1 = \left( \frac{1 + \text{EURO$/400}}{\text{S}} \right) \frac{F}{S} - \left( 1 + \frac{\text{EUROY/400}}{400} \right) \times 400 \]

\[ GAIN_2 = \left( \frac{1 + \text{EURO$/400}}{\text{S}} \right) \frac{F}{S} - \left( 1 + \frac{\text{RJA/400}}{400} \right) \times 400 \]

where \( F \) is the three-month forward exchange rate measured in Yen per dollar; \( S \) is the spot exchange rate measured in Yen per dollar; the interest rates are converted into the per period basis; and the per-period gain measures are expressed in the annualized percentage yield by being multiplied by 400.

Covered interest parity is said to hold in the Euro currency market, since the transactions costs are minimal and there is little time lag in trading and recording. The interbank deposits in different currencies bear similar and comparable risks. The Euro-dollar market has been organized for a long time. However, the Euro market for other currencies are relatively new. Covered interest parity between the Euro-Yen and Euro-dollar deposits have been expected to be established in our data without exceptions, right after the establishment of the Euro-Yen market, which is around 1975. Measure of \( GAIN_1 \) gives the benchmark of no arbitrage gains.

Covered arbitrage operations from assets in Tokyo to Euro-dollar deposits or vice versa may be subject to various kinds of capital controls of the Japanese Government. Therefore, \( GAIN_2 \) in comparison with \( GAIN_1 \) would measure deviations from parity due to capital controls.

There is another way of looking at this effect. Taking the difference between \( GAIN_2 \) and \( GAIN_1 \), we have another measure of deviation associated with capital controls. The measure, which was used by Otani and Tiwari (1981), is expected to pick up controls on capital flows between the comparable assets, both being denominated in Yen.

\[ GAIN_3 \equiv GAIN_2 - GAIN_1 \]

\[ = \text{EUROY} - \text{RJA} \]

On the one hand, \( GAIN_3 \) is better than \( GAIN_2 \) as a measure of capital controls if there are substantial transactions costs with respect to spot and forward foreign exchange, and also if there are measurement errors in exchange rates. On the other hand, \( GAIN_2 \) would represent deviations due to capital controls more accurately than \( GAIN_3 \) when the Euro-Yen market is not well developed. The mere fact that the Euro-Yen deposit rate was not available before 1975 limits the horizon of \( GAIN_3 \). Moreover, \( GAIN_3 \) restricts our attention to arbitrage originating from Yen-asset holders (usually Japanese residents). In order to consider the possibilities of arbitrage from holders of dollar-denominated asset, a majority of Euro traders, the \( GAIN_2 \) measure is more appropriate.

In the following, we will consider both \( GAIN_2 \) and \( GAIN_3 \) as candidates for a measure of capital controls.

In the existing literature, some of the above measures are used to show or to refute covered interest parity. Either positive or negative entries mean violations to covered interest parity in

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8) Most studies on capital controls by investigating interest rate parity use the difference between the onshore and off-shore interest rates. Otani and Tiwari (1981) compared Euro-Yen and Gensaki rates. Claassen and Wyplosz (1982) studied the difference between the domestic Franc and Euro-Franc rates. It was the German Mark in Frankfurt and Zurich on which Dooley and Isard (1980) focused.
the strict sense. However, parity is said to be holding if the deviation is within a band of neutrality. It is an immediate question of what determines this band. It will be shown that the bid-ask spread seems to be sufficient to determine this band in the absence of capital controls.

Summary statistics of each gain measure are presented in Table 1. Since the capital controls in Japan were significantly relaxed in December 1980, statistics are calculated for sub-periods before and after 1980: First, three-year sub-periods and second, four-year sub-periods.

Table 1. Traditional Approach: Monthly Result

<table>
<thead>
<tr>
<th>Sampling Split of three years</th>
<th>$GAIN1$</th>
<th>$GAIN2$</th>
<th>$GAIN3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975–1977, 36 months</td>
<td>0.370</td>
<td>−1.211</td>
<td>−1.580</td>
</tr>
<tr>
<td>Mean</td>
<td>(0.836)</td>
<td>(2.182)</td>
<td>(1.944)</td>
</tr>
<tr>
<td>Standard dev.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1978–1980, 36 months</td>
<td>0.195</td>
<td>−0.599</td>
<td>0.794</td>
</tr>
<tr>
<td>Mean</td>
<td>(0.324)</td>
<td>(1.828)</td>
<td>(1.823)</td>
</tr>
<tr>
<td>Standard dev.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>— New Foreign Exchange Law was Enacted in December 1980 —</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1981–1983, 36 months</td>
<td>−0.062</td>
<td>0.051</td>
<td>0.113</td>
</tr>
<tr>
<td>Mean</td>
<td>(0.234)</td>
<td>(0.234)</td>
<td>(0.176)</td>
</tr>
<tr>
<td>Standard dev.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Alternative Sampling Split

| 1977–1980, 48 months          | $GAIN1$ | $GAIN2$ | $GAIN3$ |
| Mean                          | 0.278   | −0.698  | −0.976  |
| Standard dev.                 | (0.485) | (1.677) | (1.774) |
| — New Foreign Exchange Law was Enacted in December 1980 — |         |         |         |
| 1981–1984, 48 months          | −0.067  | 0.009   | 0.076   |
| Mean                          | (0.207) | (0.217) | (0.171) |
| Standard dev.                 |         |         |         |

Note: Covered interest parity implies a gain measure to be "close" to zero.

Relatively large deviations from parity in measure $GAIN1$ from 1975 to 1977 are somewhat puzzling, since transactions costs are minimal and there are no capital controls in the Euro markets. We might conjecture this is due to a thin market for Euro yen during these years. Indeed, according to Taguchi (1982), Yen assets held by nonresidents at banks abroad grew from 0.6 billion dollars in 1975 to 3.1 billion dollars in 1977. The thin market might have prevented brokers from exploiting scale economies in operations.

Variability represented by standard deviations of $GAIN1$ is reduced in the second three-year sub-period to a level less than a half of what it was during 1975–1977. This may be due to the increase in capital flows to and from Japan due to gradual capital deregulations in Japan and the resulting expansion of the Euro-Yen market. The decrease in standard deviations of $GAIN1$ from the first to the second three-year sub-period is as great as that from the second to third
sub-period. However, as for $GAIN_2$ and $GAIN_3$, changes in standard deviations from the
second to the third subperiod (before and after of the new law of 1980) are much more drastic:
they are reduced by about 90%. After 1980, the deviations from parity expressed in mean and
standard deviations of $GAIN_2$ are no more than those of $GAIN_1$. For the period after Decem-
ber 1980, standard deviations of $GAIN_2$ and $GAIN_1$ are roughly 0.23. These facts strongly sug-
gest that deviations from parity before the new law of 1980 were because of capital controls
imposed in and out of Japan. The mean of deviations from parity has been on average less than
1/20 of one percent, since 1980. In sum, parity has been holding closely since 1981.

There are at least two interesting questions which cannot be answered from Table 1. First, the
large standard deviations of $GAIN_2$ and $GAIN_3$ before December 1980 do not tell us which
way the deviations were directed. Means of $GAIN_2$ and $GAIN_3$ show that investing in
Yen-denominated assets were on average more profitable than otherwise by a slight margin, but
standard deviations are too large to conclude this with confidence. A plot of a gain measure
should be examined to determine whether deviations from parity are just random or are serially
correlated.

Second, since most strict capital controls were in effect before 1974, it is of great interest to
examine the gain measure in the early 1970's. In order to investigate covered interest parity dur-
ing the turbulent years of the early 1970's, we have to rely on time series of $GAIN_2$ to answer this
question, since the data of $EUROY$ are not available prior to 1975. Figure 1 shows how $GAIN_2$
changes from 1972 to 1984. All entries of $GAIN_2$ are also reported in Appendix, in the hope that
they could be as the variable representing the effectiveness of capital controls used in the future
study of capital mobility and portfolio balances.

Between 1971 and 1974, just after the demise of the Bretton-Woods regime, the Japanese
government tried to avoid a rapid appreciation of Yen and kept strong capital controls. Let us
focus on the period 1972-1974. This period is characterized by wild fluctuations in apparent gain
measures. For example, in December 1973, $GAIN_2$ reached as high as 28.5%. In that month
Gensaki was 13.85% and $EUROD$ was 10.13%, while the spot rate was ¥280/$ and the forward
rate was ¥302/$. This is in contrast to the case in February 1973, when $GAIN_2$ was below
-10%. The Japanese interest rates were determined quite independently from the forward
premium (expected depreciation of Yen, i.e., $S < F$) or the Euro-dollar interest rate. Most of
these fluctuations in $GAIN_2$ can be attributed to the fluctuations in the forward premium or dis-
count, with comparable interest rates. These are sufficient evidence that in the early 1970's, the
Japanese capital market was isolated from the rest of the world, as conjectured in Section 2. Any
unexploited gains from arbitrage in these periods were due to strong capital controls which made
Japanese instruments unavailable to non-residents and placed strong restrictions on the acquisi-
tion of foreign securities by the Japanese. The forward contract was allowed to the Japanese
only if the contract was related to export and import.

Between 1975 and February 1979, deviations from parity were in a direction such that there
were apparent arbitrage gains toward Yen-denominated assets. That was particularly true in the
beginning of 1975 and in all of 1978. Capital controls on inflow were binding because of a strong
demand for Yen prompted by a rapid appreciation of Yen until the end of 1978. As explained in
Section 2, the purchase of Gensaki by non-residents was not allowed until May 1979 and other
restrictions on foreign borrowings by Japanese were lifted in December 1980. It can be seen from Figure 1 and Table 1 that these deregulations seem to have established covered interest parity between Gensaki and dollar-denominated assets. However, this remains a conjecture until we separate deviations due to capital controls from those due to transactions costs. In the next section, we will propose new measure of "one-way" arbitrage gain which is more explicit than the idea of a band of neutrality.

4. Effects of Capital Controls: One-way Measures between 1975 to 1984

In this section, we define measures for arbitrage gain taking into account explicitly the bid-ask spread for the exchange rates, the bid-ask spread of the Euro-currency deposit rates and the transactions tax for the Gensaki asset. First, the exchange rate available to a seller of Yen is not the same as the one to a buyer. Therefore, a measure of covered interest arbitrage gain should involve different exchange rates depending on the direction of a flow of funds. Second, we may approximate the opportunity cost of giving up Euro-currency deposit by the bid-ask spread in Euro-currency deposit, which is 0.125 percentage point. Of course, if the origin of investment is
cash instead of a certificate of deposit, the transactions costs (the bid-ask spread) of Euro-
currency deposit does not have to be considered. Third, covered interest parity implies that
there are no gains of arbitrage in either direction, which show up as non-positive entries for the
two one-way gain measures involving the same assets. The transactions tax for Gensaki depends
on the instrument and on who is trading. The loss on the annualized yield of typical Gensaki
arrangements between a security company and a client with Government bonds as an instru-
ment is estimated to be 0.16%. The yield published is after tax. Therefore, the opportunity cost
of sales in Gensaki is 16 basis points higher than the after-tax yield. This will be taken into
account in the calculation below.

Let us denote the “ask” rate of spot and forward exchange rates by $SA$ and $FA$, respectively.
(Here, the “ask” rate of spot yen is defined as the amount of Yen the Yen-buyer receives for one
dollar. That is, the “ask” rate of spot yen in this paper is a reciprocal of the usual “ask” rate of one
spot yen expressed in terms of Dollar.) Then our new measures of arbitrage gains are defined
for different pairs of assets in two directions. As in the preceding section, Gain measures 1 com-
pare yields on offshore assets in different denominations, while gain measures 2 concern the
relationship between offshore (Euro) and onshore (Tokyo) assets. If apparent profit opportuni-
ties are detected in $GAIN^2$ but not in $GAIN^1$, then that would be a strong evidence of capital
controls. Gain measures 3 compare two Yen-denominated assets, one in Tokyo and one in the
Euro-market. Possible arbitrage gain of a dollar-denominated asset over Yen-denominated asset
has a suffix $A$ after the number of the gain measure, and a gain measure in the reverse direction
has a suffix $B$. The gain measures, such as $GAIN^1_A$ and $GAIN^1_B$, thus compares opportunities of
different assets for an investor with cash. However, a majority of investors in the Euro market
already has the security, so that they have to sell with the transactions costs to purchase another
security. For those investors, the bid-ask spread for three-month deposit rates, 0.125% point,
should be used in addition to using the bid-ask spread for the exchange rates. Consider an arbi-
trage operation of selling the Euro-Yen deposit certificate at the ask rate and investing in the
Euro-dollar at the bid rate. The gain from this operation, $GAIN^1_{AA}$ is 0.125 less than $GAIN^1_A$.
The double suffix, $AA$ or $BB$, implies that the transactions costs of Euro-currency deposits are
also taken into account. That is, a measure with a suffix $A$ or $B$ compares two assets from the
viewpoint of investors with cash in hand, while a measure with suffix $AA$ or $BB$ compares two
assets from the viewpoint of investors who already invested in securities. The latter investor
have to bear the transactions costs (the bid-ask spread) of securities in addition to those of foreign
exchange. Let us summarize different kinds of gain measures.

From offshore Yen to offshore Dollar Deposit

\[
GAIN^1_A = \left[ \left( 1 + \frac{EUROS}{400} \right) \frac{FA}{S} - \left( 1 + \frac{EUROY}{400} \right) \right] \times 400
\]

\[
GAIN^1_{AA} = GAIN^1_A - 0.125 \text{ (the bid-ask spread of the deposit rate)}
\]

9) Kreicher (1982) used the bid-ask spread of Euro-Dollar deposit rates in his calculation of one-way arbi-
trage gains between the Euro-Dollar and CD rates in the U.S. Lizondo (1983) and Frenkel and Levich
(1975) were also careful enough to make distinction between arbitrage conditions for cash-holders and
security holders.

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From offshore Dollar to offshore Yen Deposit

$$GAIN1_B = \left[ 1 + \frac{EUROY}{400} \frac{SA}{F} - \left( 1 + \frac{EUROS}{400} \right) \right] \times 400$$

$$GAIN1_{BB} = GAIN1_B - 0.125$$

From onshore Yen to offshore Dollar Deposit

$$GAIN2_A = \left[ 1 + \frac{EUROS}{400} \frac{FA}{S} - \left( 1 + \frac{RJA + 0.16}{400} \right) \right] \times 400$$

From offshore Dollar to onshore Yen Gensaki

$$GAIN2_B = \left[ 1 + \frac{RJA}{400} \frac{SA}{F} - \left( 1 + \frac{EURD}{400} \right) \right] \times 400$$

$$GAIN2_{BB} = GAIN2_B - 0.125$$

$$GAIN3_{AA} = EUROY - (RJA + 0.16)$$

$$GAIN3_{BB} = RJA - (EUROY + 0.125)$$

For example, $GAIN2_B$ measures whether an economic agent in the Euro market currently holding three-month Euro-dollar deposits would rather invest in three-month Gensaki in Tokyo. Asymmetry with respect to $RJA$ arises from the transaction tax which is charged for sales of Gensaki asset. $GAIN3_{AA}$ and $GAIN3_{BB}$ are gain measures which do not involve transactions costs of foreign exchange, but those of securities.

Theory predicts that a gain measure is non-positive not only on average but also in each entry. "One-way" covered interest parity implies that any $GAIN$ measure should be non-positive all the time. By counting the number of months with positive gain measures, we can detect apparent arbitrage profit opportunities. Apparent arbitrage profit opportunities detected by monthly $GAIN$ measures are presented in Table 2. The top half of Table 2 shows the number of positive entries (violation of the parity) for each series in each year after 1975. Means and standard deviations for the periods before and after the new law of 1980 are summarized in the bottom half of Table 2.

It is just as theory predicts that two "one-way" gain measures in the Euro-market, $GAIN1_A$ and $GAIN1_B$, stay negative from 1978 on with few exceptions. The means of these measures, therefore, are negative. Standard deviations become smaller, indicating that any factors affecting covered interest parity have become stable. For example, transactions costs other than the bid-ask spread have become uniform for all participants in the Euro-Yen market due to the market's expansion. Major violations to parity and a large swing in $GAIN1$ measures in 1976 suggest that the Euro-Yen market was thin at that time.

10) Although the name of "one-way" arbitrage is adopted from Deardorff, our definition is slightly different from his. We mean by one-way arbitrage a one-directional arbitrage between three-month assets denominated in home currency and a set of operations consisting of selling home currency in the spot market, investing in foreign assets, and buying home currency in the forward market. Deardorff considered an arbitrage between buying foreign currency in the spot market and a set of operations consisting of investing (lending) in an asset denominated in home currency, selling home currency in the forward market, and selling short (borrowing) a foreign asset. Since both usages express the same phenomenon, covered interest arbitrage, our modified usage is appropriate.
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Table 2  One-Way Arbitrage: Monthly Result

<table>
<thead>
<tr>
<th>Gain Measure</th>
<th>1_A</th>
<th>1_B</th>
<th>2_A</th>
<th>2_B</th>
<th>1_AA</th>
<th>1_BB</th>
<th>2_BB</th>
<th>3_AA</th>
<th>3_BB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investor</td>
<td>¥-cash</td>
<td>$-cash</td>
<td>¥-Gensaki</td>
<td>$-cash</td>
<td>¥-depo</td>
<td>$-depo</td>
<td>¥-depo</td>
<td>Yen</td>
<td>Yen</td>
</tr>
<tr>
<td>opportunity</td>
<td>(origin mkt.)</td>
<td>Euro</td>
<td>Tokyo</td>
<td>Euro</td>
<td>Euro</td>
<td>Tokyo</td>
<td>Euro</td>
<td>Yen</td>
<td>Yen</td>
</tr>
<tr>
<td>destination</td>
<td>(destination)</td>
<td>$-depo</td>
<td>Euro</td>
<td>$-depo</td>
<td>Euro</td>
<td>$-depo</td>
<td>Euro</td>
<td>Yen</td>
<td>Yen</td>
</tr>
<tr>
<td></td>
<td>75:1-75:12</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>11</td>
<td>0</td>
<td>3</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>76:1-76:12</td>
<td>8</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>4</td>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>77:1-77:12</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>2</td>
<td>0</td>
<td>9</td>
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<td>78:1-78:12</td>
<td>1</td>
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<td>1</td>
<td>0</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>79:1-79:12</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>80:1-80:12</td>
<td>2</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>--- New Foreign Exchange Law was Enacted in December 1980 ---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>81:1-81:12</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>82:1-82:12</td>
<td>0</td>
<td>1</td>
<td>0</td>
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<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>83:1-83:12</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>84:1-84:12</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
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</table>

Summary Statistics

<table>
<thead>
<tr>
<th></th>
<th>1_A</th>
<th>1_B</th>
<th>2_A</th>
<th>2_B</th>
<th>1_AA</th>
<th>1_BB</th>
<th>2_BB</th>
<th>3_AA</th>
<th>3_BB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975-1977</td>
<td>Mean</td>
<td>-0.01</td>
<td>-0.60</td>
<td>-1.75</td>
<td>0.98</td>
<td>-0.14</td>
<td>-0.73</td>
<td>0.85</td>
<td>-1.74</td>
</tr>
<tr>
<td></td>
<td>(Std dev)</td>
<td>(0.85)</td>
<td>(0.82)</td>
<td>(2.21)</td>
<td>(2.17)</td>
<td>(0.85)</td>
<td>(0.82)</td>
<td>(2.17)</td>
<td>(1.94)</td>
</tr>
<tr>
<td>1978-1980</td>
<td>Mean</td>
<td>-0.35</td>
<td>-0.50</td>
<td>-1.30</td>
<td>0.31</td>
<td>-0.47</td>
<td>-0.63</td>
<td>0.18</td>
<td>-0.95</td>
</tr>
<tr>
<td></td>
<td>(Std dev)</td>
<td>(0.48)</td>
<td>(0.36)</td>
<td>(1.87)</td>
<td>(1.86)</td>
<td>(0.48)</td>
<td>(0.36)</td>
<td>(1.86)</td>
<td>(1.82)</td>
</tr>
<tr>
<td>1981-1983</td>
<td>Mean</td>
<td>-0.59</td>
<td>-0.30</td>
<td>-0.64</td>
<td>-0.42</td>
<td>-0.72</td>
<td>-0.43</td>
<td>-0.54</td>
<td>-0.05</td>
</tr>
<tr>
<td></td>
<td>(Std dev)</td>
<td>(0.28)</td>
<td>(0.33)</td>
<td>(0.28)</td>
<td>(0.32)</td>
<td>(0.28)</td>
<td>(0.33)</td>
<td>(0.32)</td>
<td>(0.18)</td>
</tr>
</tbody>
</table>

Note: 1. Covered interest parity implies a gain measure to be negative.  Destination means that alternative way of an investing asset WITH forward risk coverage. For example, GAIN1A compares investing yen into Euro-Yen deposits (original market) against covering Yen to dollar and buy Euro dollar deposits (destination) with forward selling of dollar.  2. Violations (positive entries) in #A or #AA series imply the restrictions on conversions to dollar-denominated assets or capital flows OUT of Japan.  3. Violations (positive entries) in #B or #BB series imply the restrictions on conversions to Yen-denominated assets or capital flows INTO Japan.

Gain measures between Euro-Dollars and Gensaki, GAIN2_A and GAIN2_B, show a different picture. The number of positive entries and means of GAIN2_B before 1979 suggest that there were substantial unexploited profit opportunities from the Euro market toward the Gensaki asset. This was due to the capital controls in place then in Japan, in particular a barrier to inflows of capital. As explained in Section 2, purchase of Gensaki by non-residents was prohibited until May 1979. Non-residents could only invest in other securities, such as treasury bills, which had
T. Ito: Capital Controls and Covered Interest Parity Between the Yen and the Dollar

interest rates “fixed” lower than the Gensaki rate before May 1979; the Gensaki market had been the only open market with a flexible interest rate.\(^{11}\) Therefore, apparent profit opportunities shown above reflect both capital controls in terms of prohibiting non-residents from purchasing Gensaki and the low interest rate policy affecting yields on alternative assets. Moreover, securities with maturities less than five years and one month were out of nonresidents’ reach and marginal reserve requirements for “free” yen account were raised to 100% to discourage bank deposits from March 1978 to February 1979. Positive entries of $GAIN_{2A}$ persisted until the end of 1980. This suggests that deregulation of outflows of capital in 1977 was not enough to establish parity, and that it was the new law of 1980 which made parity hold. In order to see how lifting the capital controls affected the measure, $GAIN_{2A}$ and $GAIN_{2B}$ are plotted in Figure 2.

We now extend our analysis into finer frequencies and precise timings. For the Euro market, daily data of three-month deposit rates in addition to the exchange rates in both bid and ask rates are readily available after 1978. First, we would like to confirm that the new measures of

\[ \text{Figure 2} \quad \text{Deviations from Covered Interest Parity: Measured by } GAIN_{2A} \text{ and } GAIN_{2B} \]

\(^{11}\) For details, see Economic White Paper of Japan (1981, Table II-3-25).
one-way arbitrage gains are useful in daily data, too. Since the measures developed for monthly-data predict non-positive entries all the time, covered interest arbitrage is tested better in finer frequencies.

Daily (weekdays excluding bank holidays) data are available to calculate $GAIN_{1A}$, $GAIN_{1B}$, $GAIN_{1AA}$ and $GAIN_{1BB}$ after 1978. The number of violations to parity, i.e., positive entries, and means and standard deviations are reported in the upper half of Table 3.\(^{12}\)

Table 3 One-Way Arbitrage: Daily Result in the EURO Market

<table>
<thead>
<tr>
<th>YEAR</th>
<th># OF OBS.</th>
<th>$GAIN_{1A}$ Yen cash</th>
<th>$GAIN_{1B}$ Dollar cash</th>
<th>$GAIN_{1AA}$ Yen Euro depo</th>
<th>$GAIN_{1BB}$ Dollar Euro depo</th>
</tr>
</thead>
<tbody>
<tr>
<td>1978</td>
<td>256</td>
<td>60</td>
<td>35</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>1979</td>
<td>251</td>
<td>43</td>
<td>34</td>
<td>22</td>
<td>34</td>
</tr>
<tr>
<td>1980</td>
<td>252</td>
<td>36</td>
<td>7</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>1981</td>
<td>252</td>
<td>4</td>
<td>30</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>1982</td>
<td>252</td>
<td>3</td>
<td>31</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>1983</td>
<td>252</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Summary Statistics

| 1978–1980: Mean | $-0.31$ | $-0.48$ | $-0.66$ | $-0.61$ |
|                | $(0.45)$ | $(0.47)$ | $(0.49)$ | $(0.48)$ |
|                | New Foreign Exchange Law was Enacted |
| 1981–1983: Mean | $-0.49$ | $-0.28$ | $-0.67$ | $-0.41$ |
|                | $(0.24)$ | $(0.26)$ | $(0.27)$ | $(0.27)$ |

Note: Covered interest parity implies a gain measure to be negative.

Examining the table and figures, we realize that although all reported means are negative, two $GAIN$ measures from dollar to yen have more than one-tenth of its entries violating parity every year between 1978 and 1982. However, standard deviations have been decreasing so that in 1983 there are no violations to parity. Since the Euro market has expanded, the parity between the Euro Yen and Dollar is now holding as theory predicts.\(^{13}\)

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12) Plots of daily data are available upon request from the author for $GAIN_{1A}$ and $GAIN_{1B}$. Otani (1983) shows the daily plot of $GAIN_{3}$.

13) Observations which produce gain measures with more than 10 standard deviations from the mean of the respective sub-period are “trimmed.” They are 1977:189, 1982:70, and 1983:115, where the dates are the number of weekdays.
5. Concluding Remarks

5.1 Comments on the Japanese CD market

Some readers may still think that it is rather trivial to establish covered interest parity in the absence of capital controls. First of all, it is not a trivial task to find comparable assets across boundaries. Although it is well-known that 3-month Gensaki asset is arbitrated against the Euro market, the length of the data and the technique developed to eliminate transactions costs are unique to this paper.

All studies including this paper concentrate on Gensaki as the representative yen-denominated asset without mentioning why Gensaki among other instruments has been arbitrated. For example, domestic CDs (Certificate of Deposits) have been available since May 1979, about the same time that Gensaki became available to non-residents. With respect to a (default) risk characteristic of assets, one might think that domestic CDs are a natural candidate for arbitrage from the Euro market deposits. Kreicher (1982) shows that domestic CDs in the United States are arbitrated against Euro dollar deposits. Since domestic CDs are subject to reserve requirements, an arbitrage condition shows that American CDs pay a lower interest rate than the Euro-dollar deposits. This is not the case for the Japanese CDs. The interest rate for domestic CDs has been consistently higher than the Gensaki rate or the Euro yen deposit rate. Suppose that the $GAIN_2$ measure is constructed with the Japanese 3-month CD rate instead of the Gensaki rate. Then even after transactions costs it appears that the arbitrage condition is violated: The mean of weekly $GAIN_2$ calculated with the CD selling rate replacing the Gensaki rate from June to December 1984 was .06 and positive entries outnumber negative entries by 2 to 1. This observation strongly suggests that there is some kinds of imperfection in the (issuance and secondary) CD market in Japan. As regulations on maturity, minimum size, and issuance

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14) It should be noted that a long time series for the appropriate CD rate is not available. CDs were first issued in May 1979, and the monthly time series available from the Bank of Japan is the "average over the month" instead of the "end of the month" basis, thus unfit to be used for the study of covered interest parity. Moreover, the rate reported is the issuance rate instead of the secondary market rate. The weekly data used in calculating deviations from June to December 1984, cited in the text, are the CD (issuance) selling and buying rate published in various issues of Nihon Keizai Shinbun ((Daily) Japan Economic Journal). The secondary market rates are reported up to for two months, but not for three month.

15) Several reasons are suggested why Japanese banks are willing to pay a premium to issue CDs, rather than converting Euro-funds to Yen; there is a ceiling how much CDs one bank can offer (50% of an equity value); there was a ceiling how much Euro funds could be converted to Yen; banks prefer deposits with a hope that larger deposits are rewarded by a favorable treatment from regulatory agencies, (for example, a regulation on where the bank is allowed to open a branch). However, for our purpose of explaining why the arbitrage condition failed, market imperfection in the secondary market has to be explained, that is why the CDs are not truly "negotiable". A probable answer is that the 3-month secondary CD market is very thin, as suggested by the nonexistence of data (see footnote 14). A relatively large minimum size (500 million Yen before December 1983, 300 million since December 1983 and before April 1985, and 100 million after April 1985) may have been contributing to the imperfection. If it is not truly negotiable and liquid, customers would demand a premium to hold CDs. Since restrictions on the minimum size, maturity and volume of CDs are rapidly lifted, the data on the 3-month CD rate in the secondary market may become available in the future, and it would be close to the Gensaki rate. In fact, for the duration of one month, the CD secondary market rate (repurchase agreement with CD as an asset, or the CD Gensaki) is comparable to the ordinary Gensaki rate (repurchase agreement with other securities, such as government bonds).
volume of CDs are being relaxed, we predict that the CD market will become arbitrated with the Gensaki and Euro markets. It is left for future research to explain which restriction was binding to cause the deviations cited above.

5.2 Summary

This paper examined covered interest parity between Yen-denominated and dollar-denominated assets. First, we looked at the traditional measure of apparent arbitrage gains in monthly data from 1972 to 1984. Significant deviations from the parity in 1973 and 1974 were due to strong capital controls then in place. Apparent arbitrage gain by acquiring a dollar-denominated asset by selling the Japanese asset, Gensaki, was as great as 28% point (in annual yield).

Second, in order to single out the deviations from parity due to capital controls, measures of one-way arbitrage gains which were net of transactions costs were proposed. The bid-ask spreads of foreign exchange and Euro-deposits, as well as transactions costs of Gensaki securities were taken into account for data from 1975 to 1977. According to our measures, covered interest parity has been holding in the Euro market since 1978 with a very few exceptions. However, violations of covered interest parity prior to 1978 may have been the result of a thin Euro-Yen market. Therefore, the conclusions about effects of capital controls for the period 1975–1977 are only suggestive. The standard deviations of a measure for apparent unexploited profit opportunities in the Euro-market have been reduced dramatically after 1978, while the same measure involving Gensaki did show the apparent arbitrage gains until 1980. Measures of deviations strongly suggest that capital controls were binding on possible capital flows into Japan in 1978, in that the restriction that non-residents were not allowed to purchase Gensaki was binding. Due to the low interest rate policy, assets which were available to non-residents had interest rates lower than the market (Gensaki) rate. During three years, the marginal arbitrage operation from Euro-dollar to the Gensaki securities would yield profits by 0.31 percentage point net of foreign exchange transactions costs (0.18 percentage point after the security as well as foreign exchange transactions costs). The tide changed as the yen started to depreciate in the beginning of 1979. Restrictions on capital flows out of Japan became binding as detected in violations in #A measures in 1979 and 1980 in Table 2.

After Gensaki became available to non-residents in May 1979 and the new Foreign Exchange and Foreign Trade Control Law became effective in December 1980, one-way arbitrage gains have almost disappeared, showing that these institutional changes have established free short-term capital mobility into and out of Japan.

To sum up, Japanese capital controls in place caused deviations from covered interest parity during the period from 1972 to 1979. Gradual deregulation of capital controls from 1975 to 1980 contributed to diminishing apparent arbitrage gains. Allowing nonresidents to purchase Gensaki in May 1979 and the across-the-board deregulation of capital flows in December 1980 made significant changes in the behavior of measures of apparent arbitrage gains between the Gensaki and Euro markets. Since January 1981, we have seldom observed positive unexploited arbitrage left in both offshore and onshore markets.

Established facts in this paper imply a few policy implications. First, suppose that the spot exchange rate and the dollar-denominated interest rate are beyond control of Japanese authorities. (Direct interventions in the spot exchange rate by the central banks are believed to be
powerless in sustaining more than a week a level of the spot exchange rate different from the market level. Interventions in the 80s are aimed at "smoothing out" a wild speculative movement. Then they can control only one of the two: the yen-denominated interest rate or the forward rate. The latter must be equal to the rationally expected future spot rate (according to the efficient market hypothesis), or the expected rate plus risk premium (according to the asset approach). Therefore, the Japanese monetary authorities are choosing between the domestic interest rate and the degree of Yen depreciation (or appreciation). In fact, the Bank of Japan often states that the concern for Yen depreciation (or appreciation) as a reason of changing (or sometimes not changing) the discount rate. Second, One can certainly refute a hypothesis (or a political charge often by Americans) that Japan is adopting the low interest policy in the 1980s.

As domestic short-term financial markets are integrated into the world financial market, the Japanese interest rate cannot be isolated from events outside Japan. It is simply not possible to maintain the so-called low interest policy with free capital mobility into and out of Japan.

Appendix

The following data are provided by courtesy of Data Resources Inc. (DRI) and Morgan Guaranty Trust (MG).

**EUROY, EUROD:** Daily series from 1978 to 1984 are provided by DRI. New York opening Market levels, reported by Reuters. End-of-month monthly series by MG, *World Financial Markets*, with additional observations of EUROY from its data bank.

**RJA:** Gensaki (three-month Repurchase Agreement). End-of-month monthly series between 75:1 to 84:12 by the MG data bank. (Note that the series published in *World Financial Markets* has a discontinuity over the data source, which has to be corrected.) Data prior to 75:1 are provided by the Bank of Japan.

**S, F:** Daily series from 1977 to 1983 are provided by DRI. Quotations reflect a consensus of several interbank dealers at 11:30 am, (EST), collected by Bank of America. Monthly series between 71:8 and 76:12 from IMF (ae@C158 and b@C158), and between 77:1 and 83:12 constructed from DRI daily series by picking the last business day of each month. The reason of splicing data this manner will be explained below.

**SA, FA:** Daily series from 1977 to 1984 by DRI. The same as S and F. Monthly series between 77:1 and 84:12 from DRI daily series by picking the last business day of each month. In order to obtain estimates between 75:1 and 76:12, first SA (FA) is regressed on a constant, time, S (F) and a dummy variable for December for 77:1 and 83:4, then estimating SA (FA) between 75:1 and 76:12 by extrapolation.

Further notes on the data are in order. First, it is difficult to find an alternative source for the Gensaki rate with a maturity of three months. A series for Gensaki in OECD, *Main Economic Indicators*, is unfortunately not an "end of month" series, contrary to its caption. The end-of-month series for three-month Gensaki is available from the Bank of Japan, *Annual Economic Statistics*, only after 1977. The monthly data we used were cross-checked against daily series published in newspapers in Japan for 1980-1982 without detecting any major deviations.

Second, an alternative interest rate in Japan is not available. The Tegata rate as explained is an interbank rate. However, the series for a two-month instrument is available only as daily
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averages and has been regulated in a sense until 1979. The CD rate, which is free from regulation, is available only since May 1979. Moreover, CDs are found not perfectly arbitrated against the Euro market, as discussed in concluding remarks. The treasury bill rate with a maturity of 60 days is heavily regulated. It is well below the official discount rate and the rate is changed only when the official discount rate is changed. Most of the treasury bills are simply bought out by the Bank of Japan and do not circulate in the open market. Since the treasury bill rate in Japan does not represent the short-term money market rate, it is inappropriate to use it in a study of covered interest rate parity such as one by Frenkel and Levich (1981). Third, I decided not to use the IMF monthly series of exchange rates after 1977, because cross-checking with daily data available from DRI revealed that the IMF series failed to be consistent in picking up the last business day of the month. The IMF series deviates from ours by about 2 Yen per dollar for the spot exchange rates in April 1979 and January 1982, partly because of high volatility in the rate toward the ends of those months. Using IMF data would not establish

\begin{tabular}{lcccccccc}
\hline
\hline
month & & & & & & & & \\
1: & -2.18614 & 0.08227 & 6.40077 & -3.39121 & -1.18660 & -0.61087 & -2.57029 \\
2: & -0.05383 & -10.74420 & 16.58043 & -3.39121 & -0.75923 & -1.13110 & -3.70165 \\
5: & -0.97760 & 1.05419 & 0.18332 & -3.78034 & 0.26089 & -0.58274 & -2.06471 \\
6: & -2.39180 & -1.44578 & 0.32072 & -5.00491 & 0.22959 & -0.33276 & -1.54694 \\
7: & -1.11923 & -1.93799 & -1.46479 & -4.02528 & -0.18048 & 0.04000 & -2.81565 \\
8: & -1.29513 & 1.81428 & -0.04977 & -1.03909 & -0.57681 & -0.95948 & -2.41754 \\
9: & -0.21354 & -1.10065 & 0.26131 & 5.10412 & -0.12194 & -1.63875 & -1.91254 \\
10: & -1.95132 & 7.50717 & -0.24166 & -0.36682 & 0.43739 & -0.49803 & -1.81357 \\
11: & -0.27336 & 15.21771 & -1.04344 & -1.21391 & -0.70618 & -2.23388 & -3.63348 \\
12: & -2.31112 & 28.50450 & 0.57003 & -2.02713 & -0.64342 & -3.82191 & -4.36820 \\
\hline
\end{tabular}

\begin{tabular}{lcccccc}
\hline
\hline
month & & & & & & \\
1: & -1.80907 & 0.48695 & 0.25714 & 0.14719 & 0.01410 & -0.01203 \\
2: & -1.71354 & 0.78062 & -0.07086 & -0.16273 & 0.02914 & -0.06830 \\
3: & 1.04549 & 2.85403 & 0.07198 & 0.18561 & -0.14576 & -0.17742 \\
4: & 0.08084 & 1.36102 & 0.63002 & 0.43034 & -0.11687 & -0.05390 \\
5: & -0.00092 & 0.54130 & 0.04605 & -0.23216 & 0.06839 & -0.05371 \\
6: & 0.40166 & 1.68078 & -0.09759 & -0.28804 & 0.00972 & -0.17367 \\
7: & 0.11792 & 1.09145 & -0.33526 & -0.11368 & -0.03773 & -0.08343 \\
8: & 0.77643 & 0.93922 & -0.39176 & 0.41889 & 0.02532 & -0.13513 \\
9: & -0.22134 & 0.84972 & 0.00742 & 0.12584 & -0.08905 & -0.24856 \\
10: & 0.95568 & 0.42045 & -0.01166 & 0.05829 & -0.09500 & -0.15634 \\
11: & 0.65569 & 0.69892 & 0.17309 & 0.35801 & 0.49576 & -0.05069 \\
12: & 0.74626 & -0.89429 & 0.38122 & 0.18905 & -0.09264 & -0.17637 \\
\hline
\end{tabular}

\[\text{GAIN2}\]
marked decreases in standard deviations of the gain measure even between the Euro-Yen and Euro-dollar rates.

Fourth, the Euro deposit rates provided by MG are cross-checked against daily series from DRI. The discrepancy is minimal and the problem mentioned above about the spot exchange rates does not apply to the deposit rates.

The table above is a time series of calculated $GAIN_2$ measure (defined in text). This series can be used as the indicator of effectiveness of binding capital controls from 1972 to 1984.

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REFERENCES


